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Selected US specifications from IPC sub-class B29D

(54) Reinforced profile members and methods of making the same

(57) In a method of manufacturing a reinforced profile member (100) a hollow profile member part (100a) of plastics material or of a plastics-fibre mixture and having at least one hollow chamber (300) extending therethrough is first produced, and after hardening of this profile member part a strengthening hardenable plastics filling or plastics-fibre mixture filling is introduced into the or each chamber. In order to increase the resistance to bending of the profile member, simultaneously with the introduction of the filling into the or each chamber, a core (200) is inserted in such a position that the core is put under tension if the profile member is subjected to a bending stress. The core consists of an inextensible material and can have a filamentary, rod-like, strip-like or other shape. Additional cores (500) may be embedded in the material of the profile member part.

FIG. 3

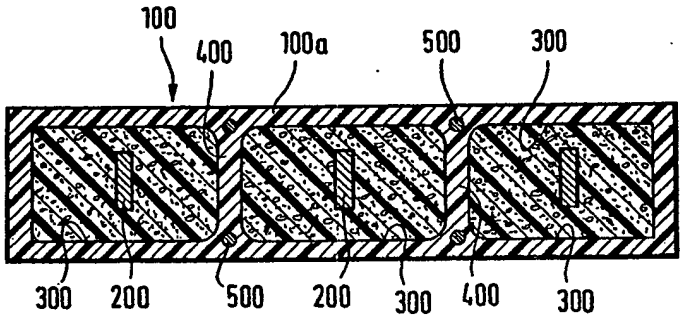

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FIG. 1

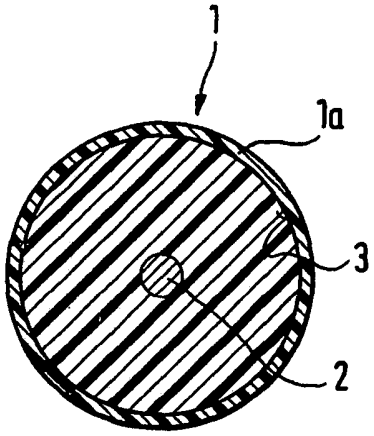


FIG. 2

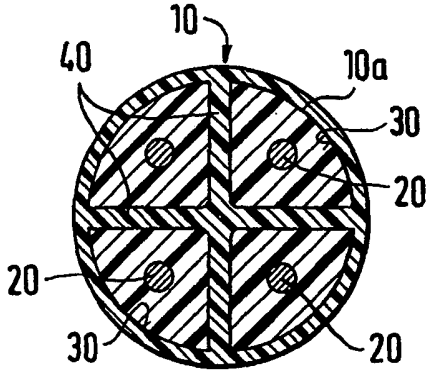
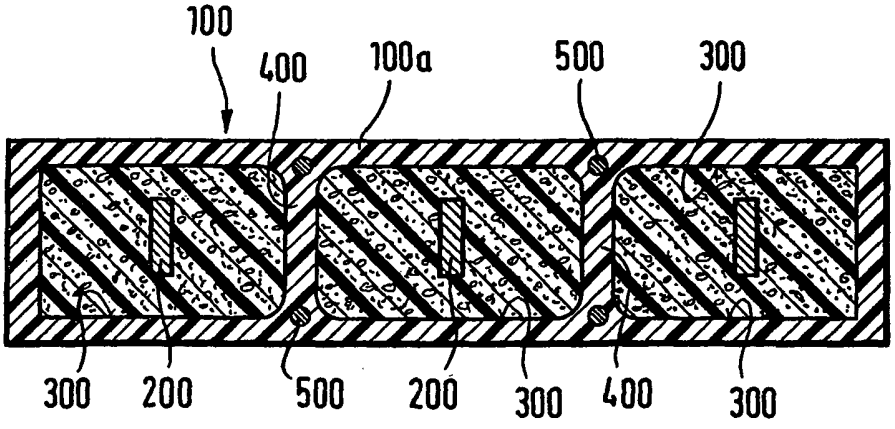


FIG. 3



SPECIFICATION

Reinforced profile members and methods of making the same specification

This invention relates to reinforced profile members and to methods for the manufacture of such reinforced profile members. The invention is concerned with profile members and methods in which a hollow profile member having one or more hollow chambers is first produced by means of an extrusion process and then a reinforcing, hardenable filling is introduced into the hollow chamber or chambers.

It is already known to introduce a plastics filling material into a hollow chamber extending in the longitudinal direction through a profile member for mechanically strengthening the profile member, such as for example in the case of a curtain rail made of plastics material and having one or more tracks. This filling suitably can comprise a plastics material-fibre mixture in which the fibres suitably are wood fibres so as to reduce the weight.

Such a mechanical reinforcement of a profile member with the help of an extruded in, hardenable plastics material or a plastics material-fibre mixture is sufficient for applications where the respective profile members are not subjected especially to a bending force, such as for example profile members having the form of a curtain rail, since these profile members usually are mounted flush on the ceiling of a room and are also held at a number of positions, so that the bending forces can be kept relatively small.

However, if profile members such as for example plank-like or board-like profile members are used for the boarding or cladding of a balcony for example, then for such an application special requirements arise with respect to the strength and the mechanical load-bearing properties of the profile members, and in particular with respect to their transverse-bending strength.

The increase in the mechanical strength and in the stiffness of the profile member which can be obtained by the usual means is no longer sufficient in these cases.

It is therefore an object of the invention to provide an improved reinforced profile member and method of manufacture thereof, so that profile members with a comparatively low weight are able to withstand high bending forces and so that the bending of the profile members can be kept relatively small even when the profile members are of substantial length.

In accordance with the invention there is provided a method of manufacturing a reinforced profile member, wherein a profile member part having one or more hollow chambers is produced by an extrusion process and a reinforcing, hardenable filling comprising plastics material is introduced into said at least one hollow chamber, wherein simultaneously with the introduction of the reinforcing filling into said at least one hollow chamber at least one core to extend along the whole length of the profile member part and made of a substantially inextensible material is introduced in such a position within the put under tension when the profile member is subjected to a bending stress.

Also in accordance with the invention there is provided a reinforced profile member comprising a profile member part having one or more hollow chambers therethrough, and a reinforcing hardened filling comprising plastics material within the or each of said chambers, wherein within the filling in the or each chamber there is a core extending along the whole length of the profile member part and made of a substantially inextensible material and positioned so that the core or cores is/are put under tension when the profile member is subjected to a bending stress.

According to the invention, simultaneously with introducing the reinforcing filling into said at least one hollow chamber of the profile member part a core is co-extruded into this filling so that the core is fixedly embedded into the material of the filling and after the hardening of the filling is held on all sides over the whole length thereof. The core should preferably be arranged in such a position within the cross-section of the profile member part that upon subjecting the profile member to a bending force the core is put under maximum tension.

It has been found that this kind of reinforcement brings about particularly great advantages if the profile member is made plank-like or board-like and is used for example for cladding or boarding a balcony.

Even in the case of a break in the profile member, the two broken portions will remain connected together at the rupture zone by means of the core, so that the profile members of the invention ensure extremely high safety.

Both the profile member part and also the filling within said at least one chamber can be made from a mixture of plastics material and fibres. Preferably, wood fibres are used in the plastics-fibre mixture.

Thus, profile members can be manufactured which are particularly light in weight, but which are still capable of withstanding high mechanical bending forces with negligible bending.

The core which is co-extruded into the filling can be made from very different materials and can also have very different shapes. The core suitably is made from steel, iron, copper, nickel or from another metal for example, but can also be made of glass filament or glass fibre, a textile fibre or furthermore of twisted or stranded fibres of the above-mentioned materials.

Furthermore, not just a single core, but a plurality of cores, can be co-extruded into the or each hollow chamber of the profile member part in order still further to increase the bending load which the profile member can withstand.

Furthermore, the core can have a circular, a rectangular, a square or a tubular cross-section, depending on the particular application.

In one advantageous embodiment according to the invention the core within said at least one chamber of the profile member part is introduced therein together with a foamable plastics filling. With this embodiment the special advantage is obtained

extrusion of the plastics filling a pressure is exerted on all sides against the core, and therefore the core is fixedly embedded into the plastics filling and is circumferentially held along its whole length.

Tests have shown with this latter construction and method even a core having a flat outer surface can be used, such as for example a glass filament having a smooth outer surface, since by means of the foaming process of the plastics material the core is clamped with great force within the plastics filling.

The method and product according to the invention can be further improved if in the manufacture of the profile member part by the extrusion process an additional core is co-extruded into sections of the profile member part having a greater than average material cross-section. The profile member part itself is then reinforced by means of one or more cores so that the tendency of the profile member part to bend is already much reduced.

The profile member according to the invention can have very different cross-sectional shapes and cross-sectional configurations, such as for example a circular cross-section, a rectangular (plank-like) cross-section, or any other cross-sectional shape.

The product and method according to the present invention is in particular suitable for the manufacture of window frames of plastics material, of cladding profiles for balconies, and for all applications where profile members are required which are subject to bending loads and which should have a high resistance to bending.

In order that the invention may be fully understood a number of embodiments will be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a cross-section of a first embodiment of profile member in accordance with the invention, having a single core and with a circular cross-sectional shape;

Figure 2 shows another embodiment of profile member in accordance with the invention, the profile member having substantially the same cross-sectional shape as in Figure 1; and

Figure 3 is a cross-section of a board-like profile member in accordance with the invention which is suitable for taking up extremely high bending forces.

Figure 1 shows a cross-section through a rod-like profile member which is designated generally by 1. The illustrated profile member 1 comprises a hollow tubular portion 1*a*, which is made by an initial extrusion process. After the hardening of this tubular hollow profile member 1*a* a filling including a centrally arranged core 2 is introduced for example by means of a further extrusion process into the hollow chamber 3 of the tubular profile member and the structure thus obtained is then hardened. The core 2 can have any one of very many different shapes: according to the embodiment of Figure 1 it is rod-like and has a circular cross-section.

The core 2 suitably is arranged within the hollow chamber 3 at such a position that with bending of the profile member perpendicular to the longitudinal direction thereof the core 2 is placed in tension. Therefore, if the material of the core 2 is chosen so that it is inextensible or nearly so, then the core 2 is strengthened against a bending stress.

In the embodiment shown in Figure 2 the profile member is designated generally at 10 and compris s a prefabricated tubular hollow profile member 10*a*. This hollow profile member, in contrast to the embodiment according to Figure 1, has four juxtaposed hollow chambers 30 which are separated one from the other by means of internal ribs 40. Fillings are introduced into the four chambers of the prefabricated hollow profile member 10*a*, by the use of a further extrusion process, each filling having its own core 20. In this embodiment again, each core 20 is rod-like with a circular cross-section.

With this cross-sectional shape of the hollow profile member 10, some strengthening against a bending load is already achieved. This strengthening is substantially increased however by the filling and in particular by the four cores 20.

In the embodiment according to Figure 3 the hollow profile member 100 has a board-like or plank-like cross-section and comprises three chambers 300 separated by partition walls 400 one from the other. The profile member again comprises a prefabricated hollow profile portion 100*a* which is already formed with a special construction. In the case of the hollow profile member 100*a*, a number of cores 500 are already embedded therein at positions where the material cross-section is greatest, such as for example at the corner areas of the central hollow chamber. The cores 500 extend along the whole length of the profile member 100. The cores 500 are arranged at positions such that if the profile member is bendingly loaded (perpendicular to the longer side surface) at least two cores 500 are put under tension. Therefore, the prefabricated hollow profile member 100*a* already has a substantial strength.

Then, after the manufacture of the hollow profile member 100*a* and after the hardening thereof, a filling having its own core 200 is introduced into each of the hollow chambers 300, for example by means of a subsequent extrusion process. In this embodiment the respective cores 200 each comprise a strip-like material having a substantially rectangular cross-section.

Both the fillings 300 and also the strip-like cores 200 act as an additional stiffening against bending loads, so that the profile member according to Figure 3 is particularly suitable for applications where high bending forces can occur and can also b used where a rupture of the profile m mber could result in dangerous conditions, as for example in th case of a balcony plank or in the case of a balcony floor.

Even if the profile member according to Figure 3 should break as a result of being subjected to an excessive bending load the two broken profile portions will not be fully separated one from the other because they will still be connected by the cores 500 and 200. In the case of the aforementione applications, i.e. for balconies for example, the material of the cores 500,200 preferably should be steel or another strong material.

To a person skilled in the art it will be appreciated that both the cross-sectional shape of the cores and also the material of the cores can be changed with

broad limits and can be adapted to the particular application and to the particular profile of the profile member.

One very advantageous embodiment of the invention consists in using, as the filling for filling the hollow chamnbers 3,30,300, a foamable filling, such as for example a foamable plastics or plastics-fibre mixture, because then the cores 2, 20,200 in view of the foaming action are embedded with high force into the plastics filling and are held on all sides by the plastics filling.

The cores can be formed from individual filaments or individual fibres, or can be made from twisted or stranded fibres or can even be tubular.

Furthermore, the material of the cores can be glass, a textile material, plastics material, glass-fibre reinforced plastics material, copper or nickel, etc.

Both the filling and/or the hollow profile member can be produced from a purely plastics material, or from a plastics-fibre mixture, and in particular from a plastics-wood fibre mixture. This results in the profile members being relatively light in weight, but still having a high capability of withstanding mechanical bending loads. Therefore, these profile members can be used with particular advantage in situations where a very low weight is preferred but simultaneously a high mechanical bending strength is demanded.

PVC (polyvinylchloride) or any other suitable plastics material can be used as the plastics material, either alone or with additions such as fibre.

Furthermore, there is also the possibility of providing the outer surface of each core 2,20,200 with recesses, grooves or notches extending transversely to the longitudinal direction of the core and into which the plastics material surrounding the core penetrates, so that the core is fixedly anchored within the plastics material.

CLAIMS

1. A method of manufacturing a reinforced profile member, wherein a profile member part having one or more hollow chambers is produced by an extrusion process and a reinforcing, hardenable filling comprising plastics material is introduced into said at least one hollow chamber, wherein simultaneously with the introduction of the reinforcing filling into said at least one hollow chamber at least one core to extend along the whole length of the profile member part and made of a substantially inextensible material is introduced in such a position within the chamber or chambers that the core or cores is/are put under tension when the profile member is subjected to a bending stress.

2. A method according to claim 1, in which the profile member part is produced by a first extrusion process, and the filling and core or cores are co-extruded into the profile member part in a subsequent extrusion process.

3. A method according to claim 1 or 2, in which in the manufacture of the profile member part by an extrusion process an additional core or cores is/are co-extruded into zones of the profile member part section.

4. A method according to any preceding claim, in which the filling comprises a plastics-fibre mixture.

5. A method according to claim 4, which includes foaming the plastics filling into the profile member part.

6. A method of manufacturing a reinforced profile member substantially as hereinbefore described with reference to the accompanying drawings.

7. A reinforced profile member comprising a profile member part having one or more hollow chambers therethrough, and a reinforcing hardened filling comprising plastics material within the or each of said chambers, wherein within the filling in the or each chamber there is a core extending along the whole length of the profile member part and made of a substantially inextensible material and positioned so that the core or cores is/are put under tension when the profile member is subjected to a bending stress.

8. A profile member according to claim 7, in which a hardenable plastics-fibre mixture is used as the filling.

9. A profile member according to claim 8, in which the fibres in said plastics-fibre mixture are wood fibres.

10. A profile member according to claim 8, in which the fibres in said plastics-fibre mixture are glass fibres.

11. A profile member according to claim 8, in which the fibres in said plastics-fibre mixture are textile fibres or metal fibres.

12. A profile member according to one of claims 8 to 11, in which the plastics material of said plastics-fibre mixture is polyvinylchloride.

13. A profile member according to one of claims 8 to 12, in which the plastics material of said plastics-fibre mixture is a foamable plastics material.

14. A profile member according to any of claims 7 to 13, in which the or each core comprises a fibre or a filament.

15. A profile member according to any of claims 7 to 13, in which the or each core comprises a plurality of twisted or stranded fibres or filaments.

16. A profile member according to any of claims 7 to 13, in which the or each core comprises a strip material having a substantially rectangular cross-section.

17. A profile member according to any of claims 7 to 13, in which the core comprises a tube-like material having a substantially circular cross-section.

18. A profile member according to any of claims 7 to 17, in which an additional core or cores is/are provided embedded in the material of the profile member part, in zones thereof which have greater than average material cross-section.

19. A profile member according to claim 18, in which the or each additional core comprises a fibr or filament or a plurality of twisted or stranded filaments.

20. A profile member according to any of claims 7 to 19, in which the or each core and the or each additional core comprises a textile material, glass or

21. A profile member according to claim 20, in which the or each core and/or the or each additional core is made of steel, iron, copper or nickel.

22. A profile member according to any of claims 7 to 21, in which the profile member part is made of a plastics-fibre mixture.

23. A profile member according to claim 22, in which the fibres of the plastics-fibre mixture are wood fibres.

24. A profile member according to any of claims 7 to 23, in which along the outer surface of the or each core there are recesses, grooves or notches extending transversely with respect to the longitudinal direction of the core.

25. A reinforced profile member substantially as hereinbefore described with reference to Figure 1, Figure 2 or Figure 3 of the accompanying drawings.

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